7 Enabling knowledge progression in vocational curricula

Design as a case study

Suellen Shay and Diane Steyn

Introduction

By 1994 the legislative barriers that prevented access to higher education for the black majority of South Africa's qualified school leavers had been dismantled. However, from the early days of political transformation it was clear that social and legislative access were necessary but not sufficient conditions for success. In addition success in higher education requires 'epistemological access' (Morrow 2009); that is, students need to gain access to and become participants in an academic practice with its requisite forms of knowledge and methods of inquiry. Thus epistemological access is fundamentally about giving students access to what Young (2008) refers to as 'powerful knowledge'. The concern of this chapter is how vocational curricula can give access to powerful knowledge.

The focus is on a Design Foundation Course (DFC) situated in the extended first year of a Diploma offered by the Faculty of Informatics and Design at the Cape Peninsula University of Technology (CPUT) in Cape Town, South Africa.[1] The Diploma is a three-year, vocationally-oriented undergraduate qualification which sits at entry level of South Africa's higher education qualification framework. This extended first year course offers foundations for students in Interior, Industrial, Graphic, Fashion, Surface, Jewellery Design and Architectural Technology. At the end of the course, students progress to the first year of one of these design disciplines.

The official purpose of the DFC is redress; that is, widening access to talented and qualified school leavers who, due to the legacy of apartheid education, would have had limited, if any, exposure to design at school. This chapter discusses the studio-work component of the curriculum. This component has two aims: first, to introduce students to foundational or core design knowledge common to the different design disciplines it serves; and, second, to provide students with a clear, experienced-based understanding of disciplinary difference. In spite of its redress purpose, the tacit nature of design pedagogy may in fact disadvantage learners who have not been socialized into the particular forms of knowledge and dispositions required for design. Thus we set out to make more explicit this curriculum's

basis of legitimation; in other words, we aim to explore the organizing principles constituting legitimate knowledge.

We take as our starting point the principle that designing curricula which enable epistemological access requires an understanding not only of who students are, their levels of academic preparedness and the pedagogical interventions which facilitate learning but also of disciplinary knowledge and its recontextualization into curricula. In particular we are interested in the challenges of enabling epistemological access to vocational curricula that meet the external demands of vocational or professional practice. If students are to 'crack the code' to success, curriculum designers need to know what that code is. What makes this knowledge special? What is its basis of insight, status and identity?

The studio work component of the DFC curriculum comprises several drawing projects and a series of 17 design projects which students work through over the course of a year. The analysis seeks to expose what principles underpin the selection and sequence of the written briefs of these design projects. For this purpose we construct an analytical framework by bringing together research into design expertise and Legitimation Code Theory. The result is a conceptual framework that accounts for progression in levels of expertise, forms of knowledge, and the cultivation of a designer gaze.

Conceptual framework

The key question that the framework seeks to address is what makes vocational curricula special. Another way to put this is: what constitutes powerful knowledge in vocational curricula? Conceptions of 'powerful knowledge' have been strongly shaped by Basil Bernstein's metaphors of 'vertical' and 'horizontal' (2000) and their redescription in terms of 'verticality' and 'grammaticality' (Muller 2007). Powerful knowledge is associated with 'verticality', conjuring images of an upward movement rising 'beyond the present and the particular' (Moore 2009: 247) to higher and higher levels of generality and abstraction. Our argument is that while this may be helpful for conceptualizing powerful knowledge in some intellectual fields it may not be the most appropriate characterization of knowledge progression in vocational fields. Central to this argument is the conceptualization of 'context' and its relationship to knowledge practices.

The conceptual framework takes as its starting point Bernstein's model (2000) of the arena created by the 'pedagogic device' which theorizes relationships among the field of production (where 'new' knowledge is produced), the field of recontextualization (where 'new' knowledge is recontextualized into curriculum), and the field of reproduction (where educational knowledge is taught and learned). The model of the pedagogic device alerts us to the transformation of knowledge as it moves across these different fields; for example, how design knowledge produced in the field of

professional practice is recontextualized for the purpose of a specific design curriculum. While there is clearly a relationship between the knowledge practices of these different fields, according to Bernstein, recontextualization always involves 'the transformation of a real discourse into … an imaginary discourse' (2000: 33). The basis of specialization for these different knowledge practices – their organizing principles and bases of achievement – is not the same. The focus of this chapter is in the field of recontextualization and the basis of achievement in the design curriculum.

In further development of his work Bernstein (2000) sets out to describe forms of knowledge in the field of production. He begins by distinguishing 'horizontal discourse' from 'vertical discourse', or 'everyday knowledge' from 'coherent, explicit, systematically principled' knowledge (2000: 157). Within vertical discourse he distinguishes between 'horizontal' and 'hierarchical knowledge structures'. Horizontal knowledge structures characterize intellectual fields where knowledge grows through the accumulation of new approaches, such as literary criticism or much of sociology. Hierarchical knowledge structures characterize fields that grow through the integration or subsumption of previous knowledge into more general propositions and theories, such as physics.

A further distinction that Bernstein makes for characterizing intellectual fields is that of 'singulars' and 'regions'. Singulars refer to fields that are 'on the whole oriented towards their own development, protected by strong boundaries and hierarchies' (2000: 52). The horizontal and hierarchical knowledge structures noted above would be examples of singulars. In contrast to singulars, 'regions' are recontextualized singulars 'which operate in the intellectual field of disciplines and in the field of external practices' (2000: 52). Regions – medicine, engineering, architecture – face both ways: inwards towards disciplines and outwards towards fields of practice.

One issue central to Bernstein's distinctions – between the everyday and the systematic, between different knowledge structures of intellectual fields, between singulars and regions – is the relationship of the knowledge practice to its context. There are, however, different notions of context at work in these distinctions and teasing these notions out is necessary for conceptualizing progression in vocational curricula. In Bernstein's descriptions, horizontal discourses are characterized as context-dependent and vertical discourses as context-independent. The horizontal and hierarchical knowledge structures are characterized as having varying degrees of context-independence. 'Context' here is the domain of the empirical: that is, the specific experiences that constitute individuals' and communities' day-to-day practices. Bernstein argues that horizontal discourse is 'segmentally organized' (2000: 157); in other words, its meanings are context-dependent. In contrast vertical discourses, particularly hierarchical knowledge structures, are related not segmentally but 'by the integration of their meaning by some coordinating principle' (2000: 158). They are specialized or legitimated not by experience but by their capacity to integrate experiences 'to create very

general propositions and theories, which integrate knowledge at lower levels, and in this way show underlying uniformities across an expanding range of apparent different phenomena' (2000: 161). Thus the crucial movement here is from context-dependent to context-independent meanings, from empirical to theoretical generalizations. As noted above this movement has been central to notions of 'powerful knowledge' and its importance for vocational curriculum has been highlighted by numerous authors (Barnett 2006; Grubb 2006; Wheelahan 2010; Young 2008).

However, this movement from context-dependence to context-independence is not sufficient to explain progression in vocational curriculum. Progression must also account for its relationship to the contexts of application, of *practice*. Vocational curricula are recontextualized regions. Like their parent regions, vocational curricula 'face both ways'– they have dual allegiances. They look inwards towards the specific academic practices of the discipline and outwards towards the occupational practices of the profession. Bernstein notes that regionalization is likely to entail a 'change of identity towards greater external dependency' (2000: 52). One way in which this external dependency is mirrored in the curriculum is through assessment: that is, the tasks, projects or briefs that attempt to simulate the kinds of things professionals do in the field of practice. Typically in the early stages of the curriculum students encounter tasks that are decontextualized and well-defined, that is, stripped of the complexities of real-world problems. At more advanced levels the tasks become increasingly authentic and ill-defined. Ill-defined problems are open-ended and capable of generating a number of potentially successful solutions. In some cases students are required to solve actual real-world problems. In the case of design this might entail a real client seeking a design solution to a very particular problem. This suggests that progression in vocational curriculum may involve a movement from knowledge practices that are context-independent (that is, simplified and stripped of real-world complexities) to increasingly context-dependent (where solutions are highly specific to a particular problem). We propose that to understand the logic of vocational knowledge practice is to grasp both of these movements: its capacity for increasing conceptual complexity and its capacity to engage with increasingly specialized problem-situations.

To recap, this 'facing-both-ways' phenomenon (Barnett 2006: 153) has three important implications for vocational curricula. First, since these curricula draw from a wide range of disciplines, they may be integrating across different knowledge structures. Friedman (2003) identifies six 'knowledge domains' for design. These reach from the horizontal knowledge structures of, for example, the fine arts, the humanities, the social and behavioral sciences, to the hierarchical knowledge structures of, for example, engineering and the natural sciences. Second, it involves a double recontextualization process. It involves the translation of disciplinary knowledge into curriculum, what Barnett (1996) refers to as 'pedagogic recontextualization'. Vocational curricula also require that disciplinary knowledge be translated

for the purposes of solving particular work-based problems. Third, vocational curricula are explicitly about the formation of a particular kind of knower, a particular 'projected identity' (Bernstein 2000), such as becoming a designer. While Bernstein was clear that knowledge specializes consciousness, the link between knowledge and knower identity was never adequately developed in this work. However, his notion of 'gaze' highlights the acquisition of a particular perspective, a 'particular mode of recognizing and realizing what counts' (2000: 164).

In order to analytically explore the design briefs we draw on Legitimation Code Theory (LCT). LCT extends and integrates Bernstein's code theory, among others, by exploring the organizing principles of knowledge practices (Maton 2014b). This chapter draws on the Semantics dimension of LCT, and specifically the concepts of *semantic gravity* and *semantic density* (see Chapter 1, this volume).

Semantic gravity (SG) conceptualizes knowledge practices in terms of:

> the degree to which meaning relates to its context. Semantic gravity may be relatively stronger (+) or weaker (–) along a continuum of strengths. The stronger the semantic gravity (SG+), the more meaning is dependent on its context; the weaker the semantic gravity (SG–), the less dependent meaning is on its context.
>
> (Maton 2014b: 129)

As Maton (2014b: 130) emphasizes, the nature of the context for establishing the strengths of semantic gravity may take a variety of forms depending on the object of study (see also Chapter 2, this volume). For the purposes of exploring the Diploma in Design the 'context' for establishing semantic gravity comprises the context of the practices that give meaning to vocational curriculum. Thus, a move from weaker to stronger semantic gravity is here a progression from context-reduced tasks (SG–) to context-embedded tasks (SG+). Thus, strengthening of semantic gravity is illustrated by the progression of tasks from general to simulated to authentic and finally to the ill-defined problems of professional practice.

Semantic density (SD) is defined as:

> the degree of condensation of meaning within socio-cultural practices (symbols, terms, concepts, phrases, expressions, gestures, action, clothing, etc.). Semantic density may be relatively stronger (+) or weaker (–) along a continuum of strengths. The stronger the semantic density (SD+), the more meanings are condensed within symbols; the weaker the semantic density (SD–), the less meanings are condensed.
>
> (Maton 2014b: 129)

As this suggests, the nature of the meanings condensed depends on the object of study. In this research 'semantic density' refers to the degree of

condensation of the meanings of terminology, concepts and principles, and means of representation referred to in the briefs. It also refers to the level of visual abstraction required from students' responses to these briefs. The move from weaker to stronger semantic density is progression from the purely descriptive (SD–) to the more symbolic (SD+). This is illustrated, as we shall see below, in the four stages of a visual representation of an insect: from a detailed naturalistic description to a stylized graphic image capable of communicating meaning in a condensed form, for example, a logo which uses analogy to communicate corporate identity.

In Figure 1.3 (Chapter 1, this volume) semantic gravity and semantic density are conceived as axes of the 'semantic plane' that forms a field of semantic possibilities. Each of the quadrants represents a different 'semantic code' or set of organizing principles for knowledge practices. The quadrants of particular interest in this study are *rarefied codes* (SG–, SD–) and *worldly codes* (SG+, SD+), as described by Maton in Chapter 1 (this volume), or top-left and bottom-right, respectively, in Figure 7.1, below. We propose that progression in vocational curricula will be characterized by strengthening semantic gravity and strengthening semantic density. In other words, the curriculum progresses from context-reduced projects to increasingly authentic, complex and occupationally-specific problems. This progressive strengthening of semantic gravity enables the integration of increasingly complex design concepts: that is, concepts with more densely compounded meaning and descriptive power.

We offer the teaching of colour theory as an example of how both semantic gravity and semantic density are strengthened as students move through the briefs of the DFC curriculum. The basic scientific rules of colour theory (colour mixing and colour contrasts) are introduced early on in context-independent project briefs, allowing for the transfer of these concepts to later projects dealing with colour theory. These later projects are increasingly discipline specific; in other words, they have more complex simulated problems to solve. The aim is to introduce students to the contextual, historical and semantic significance of colour in design. The stronger semantic gravity of these simulated projects provides students with conceptual and experiential understanding of how colour can be used to communicate mood, express emotion, evoke historic styles and define space. The curriculum culminates in a self-portrait project that requires a nuanced understanding of how colour is able to express identity. In this manner the project-based curriculum first introduces and then incrementally compounds layers of meaning into colour theory concepts, thereby strengthening the semantic density of these concepts. Thus, LCT offers a conceptual language to describe the basis of achievement in social fields of practice. This language of description can now be used to analyse the different levels of design expertise, to which we now turn.

Methodology

In order to prepare students for the world of work, studio curricula are traditionally project driven and learning is largely by doing. The intention of these projects is to simulate the kinds of design problems likely to be encountered in the real world of design practice. These simulated projects create opportunities for students to practice visual design by engaging in the creative design process. During this process, different kinds of design knowledge are synthesized to conceptualize and visually communicate solutions to design problems of varying degrees of complexity.

In total 17 studio-work project briefs provided the data for this study. These documents and their sequence make up the material form or 'public face' (Barnett and Coate 2005: 33) of what is understood as curriculum by the lecturers involved with its design and implementation. Written project briefs serve the same purpose as instructions for a written academic assignment: they describe the project requirements in a condensed, summary fashion. Written briefs are customarily supported by more expansive verbal and visual presentations that explain the brief in more detail, provide visual examples and explain or demonstrate new terminology, procedures and techniques. The briefs use a standard template that provides a written description of the project's purpose, the assessment criteria and the suggested procedures. They may also contain images and diagrams to aid understanding.

In order to analyse these briefs a 'translation device' was developed for enacting the LCT concepts within this specific object of study (see Chapter 2, this volume). This brought together levels of design expertise (Cross 2004; Lawson 2004; Dorst 2008) with semantic codes. The full study (Steyn 2012) also included the use of specialization codes to analyse the development of different designer identities, though that analysis is not included here, for brevity. Nonetheless, given the importance of the designer identity, throughout the analysis we note (without further elaboration here) the cultivation of the designer's 'gaze'; i.e. that what Maton (2010) refers to as a 'cultivated gaze' where 'legitimacy arises from dispositions of the knower that can be inculcated' (Maton 2014b: 95).

Design researchers (e.g. Cross 2004; Lawson 2004; Dorst 2008) have adapted and extended Dreyfus' (2004) work on expertise to describe how the designer's capacity to practice design by solving design problems develops in the following stages or levels: novice, advanced beginner, competent, expert and master. While their work seeks to identify and describe distinct approaches to problem solving at each of these levels, the kinds of design knowledge required at these levels remain largely implicit. For the purpose of the analysis these levels are redescribed accounting for the design knowledge required for projects at each of the levels. Figure 7.1 visually illustrates the levels as a progressive strengthening of the semantic gravity and the semantic density of design knowledge. It also illustrates the gradual cultivation of a design gaze.

Since the focus of this study is the project-based curriculum of a foundation course, our analysis will be restricted to these first two levels, the novice and advanced beginner. However, other levels warrant brief mention because they describe the trajectory of the development of design expertise and gaze that have implications for curriculum planning. Awareness of features of more advanced levels would also enable the identification of ill-sequenced projects which are cognitively too advanced and consequently not level-appropriate for a foundation curriculum.

Naïve

This level, introduced by Dorst (2008) and not part of Dreyfus' original model, recognizes that design is not the preserve of professionals but is employed by ordinary people as part of what Bernstein (2000) termed horizontal discourse. This level is distinguished by mimicry of existing design solutions and is the one students return to when they fail to engage with the creative design process. It falls outside the scope of this study but is relevant since it marks the start of the process of developing design expertise and cultivating a specialized gaze.

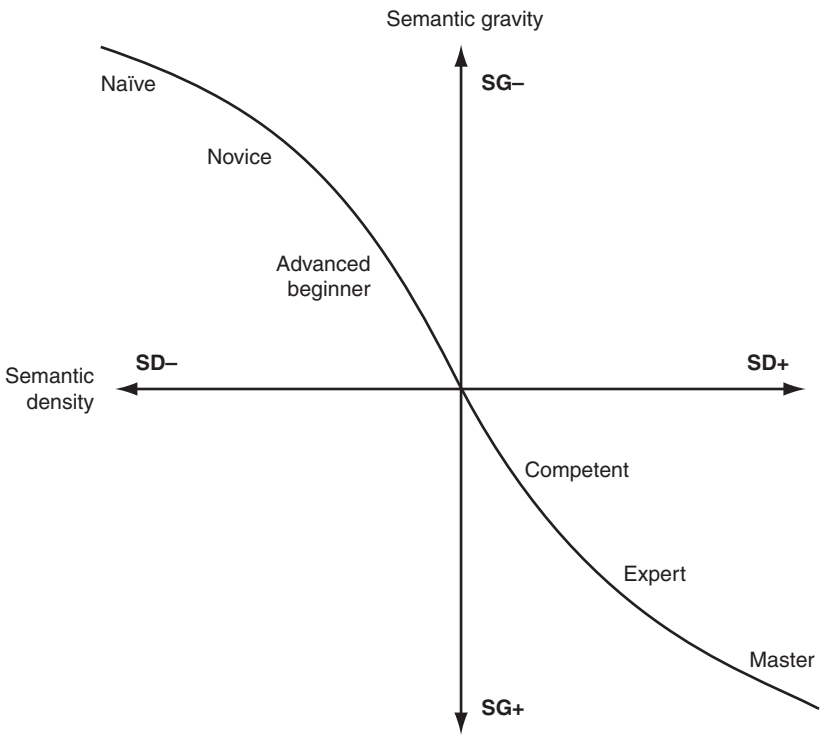

Figure 7.1 Progression of levels of design expertise across the semantic plane.

Novice

Unlike naïve designers, novices engage with the design process. Problem solving requires no prior knowledge, is largely rule-based and involves reflecting on *how* to use specified techniques and methods of representation (Dorst 2008). At this level students begin to acquire what Lawson (2004: 456) refers to as the 'design domain schemata': core disciplinary knowledge related to aesthetics, semantics, function, technology, the design process, and various techniques and methods of visual representation and communication.

Projects best suited to novice-level problem solving appear to be those which favour well-defined, context-independent problems. These problems allow students to focus on the acquisition of core disciplinary knowledge and basic techniques of representation. The focus or intention of these briefs is thus to facilitate the acquisition of design knowledge characterized by weaker semantic gravity and which is thus transferable between different design contexts.

Advanced beginner

Problem solving at the advanced beginner levels is situation-based (Dreyfus 2004; Dorst 2008). Designers at this level are increasingly able to recognize both the contextual significance and complexity of design problems. They are able to grasp how parts relate to a whole and how these parts both structure and are structured by the whole. Here the concern is not just with *how* to apply knowledge and methods but with *when* and *which* methods to apply to solve situated design problems (Dorst 2008).

Projects suited for advanced beginner problem solving appear to require the possession of some prior design knowledge to build on (Dorst 2008). Prior knowledge may include knowledge of design principles, processes and precedent. According to Lawson (2004: 456), developing a 'growing pool of precedent' is one of the primary requirements of this level. Precedent refers to examples of existing design solutions, for example consecrated work from the canon that can be used as points of departure, or scaffolding, for creating original work.

The external constraints and affordances provided by the simulated contexts of advanced beginner projects generate increased opportunities for strengthening the semantic density of design terminology and concepts. The greater authenticity of simulated design problems also calls for knowledge of more specialized materials, techniques and methods of representation and fabrication. The more ill-defined nature of situated advanced beginner problems opens up more opportunities to exercise choice and creative imagination. These problems offer a wider range of potential design solutions than would be possible for rule-based novice-level problems. At this level designers start to develop their own experience-based 'design

prototypes' (Dorst 2008: 9): more distinctively personal ways of responding to design problems. In short, advanced beginner project provide more opportunities to evoke and cultivate a specialized gaze.

Competent

At this level, design problem solving shifts significantly from reactive to increasingly strategic and reflective (Dorst 2008). Designers are able to strategically select and order information by drawing on their own embodied prototypes and experience of design practice, as well as their knowledge of relevant precedent. This capacity to discern a hierarchy of importance in design situations suggests considerable development of a specialized gaze. Projects requiring this level of self-directed problem solving would be the norm in third year design curricula since achieving competence, under supervision, is a prerequisite for postgraduate studies or for graduating and entering the world of work.

Expert

The seemingly intuitive problem solving ability of experts is based on embodied knowledge gained through experience of sustained practice. Rather than solving problems, experts simultaneously recognize the familiar patterns or 'problem types' (Cross 2004: 432) of their domain and match these problems with suitable, frequently routine solutions (Dorst 2008). Expert designers are often sought out for *who* they are and for the distinctive 'guiding principles' that inform their work (Lawson 2004: 456).

Master

The master is an expert who creates innovative as opposed to routine responses to the typical problem types of their domain. Masters use their guiding principles to initiate and oversee the creation of work which represents new knowledge in the field, gets published and/or establishes new precedents for other designers to learn from – a form of 'practice-based research' (Dorst 2008: 9).

As Figure 7.1 illustrates, we argue that the development from novice to master represents at each level an incremental progression towards context-dependent discipline-specific briefs – strengthening semantic gravity – and an incremental condensation and compounding of meanings in design concepts and principles – strengthening semantic density. This condensation of meaning is the result of the experience of practice and a growing knowledge of precedent, which can be drawn on to inform increasingly self-directed and value-driven design choices. Unlike the intuitive, untrained gaze of the naïve designer, the seemingly intuitive gaze of the expert requires conscious cultivation through sustained exposure to and experience of disciplinary knowledge and practice.

Analysis

Against the backdrop of this analytical framework, we have selected four of the seventeen projects to demonstrate the progression of knowledge and the cultivation of a design gaze. The four projects are: Less is More (P1), the Tile (P5), the Bag (P6) and Jewellery (P15). The project numbers indicated in brackets refer to their sequence in the curriculum. Figure 7.2 reveals the sequence of the projects in terms of their level of expertise and increasing semantic gravity and semantic density. The findings reveal a mismatch between the sequence of the projects in the curriculum and the progression of knowledge and the cultivation of gaze. We now turn to the analysis of the projects. All quotations in the analysis below are excerpts from the project briefs. For a fuller report of the analysis, see Steyn (2012).

Less is More

The Less is More (P1) project introduces the core design principle of visual abstraction. This entails translating 'a naturalistic drawing of an insect',

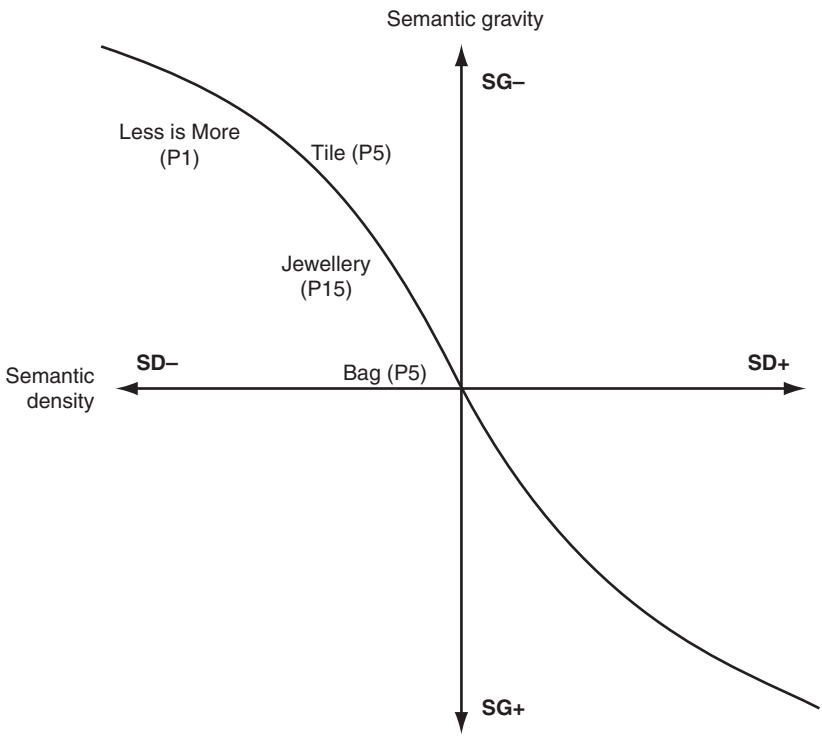

Figure 7.2 Progression of projects across the semantic plane according to their required levels of design expertise.

rendered tonally in pencil, into three 'graphic images' by means of three processes of visual abstraction: simplification and stylization, the use of positive and negative shape and the selection of a part to stand for the whole. These graphic processes are all a form of visual précis that incrementally transform a descriptive image of an insect into a graphic image able to communicate information about the characteristic appearance of the insect in a visually condensed form.

Although this is a graphic design project, it introduces core concepts and terminology of design shared by all design disciplines. Knowledge of the elements and principles of formal visual language and their potential to communicate meaning, provide designers with the vocabulary to communicate about, reflect on and evaluate both their work and the work of others. Figure 7.3 is an example of the four steps of the Less is More project and is used here to support the analysis.

The first step of this project requires a 'carefully rendered pencil drawing' of a black and white photograph of an insect. This calls for careful observation and recording of form, of proportion, of part–whole relations, of different tonal values, of line and texture. The brief furthermore introduces the concept of the figure–ground relation by requiring students to 'pay special attention to composition' by being 'aware of how the image is placed within the (square) format'. The second step of the project requires translating the pencil drawing into a 'graphic image by simplifying the forms of the insect' and 'extracting essential information from the carefully rendered pencil drawing working in black khoki, using contour line'. The resulting simplified image is then further simplified in step three by 'focusing on the negative shapes in black', leaving the positive shape of the insect white. The final step requires selecting a small part of the preceding image to represent the whole whilst 'retaining the essence of the insect'.

Considering the graphic design project as a whole, the main purpose of the project is to introduce core terminology and principles of formal visual language by means of a series of exercises in visual abstraction. These exercises do not lead to the design of a particular product with a specific purpose or end-user in mind. Rather, the content and purpose of the project remains general and relatively context-independent; in other words, its semantic gravity remains relatively weak. The intention is to enable the core design

Figure 7.3 Example of the 'Less is More' project.

principles to be transferred to subsequent projects irrespective of their disciplinary specialism.

Although the four steps of the project provide evidence of increasing semantic density as meaning moves from detailed description to a visually condensed graphic image, the semantic density of the project itself is relatively weak. These images are not required to communicate additional layers of meaning related to an external context. For example, at a later stage these generic principles of stylization and simplification could be put to work to create a logo. Logos are graphic images of potentially stronger semantic density that use analogy to represent multi-layered brand identities of companies or organizations, such as a bee to represent the efficient service of a courier company, an elephant to signify the strength of cement, or an umbrella to represent insurance cover.

The project thus appears to be appropriate for the novice level: it does not require prior knowledge to complete. It requires adherence to strictly prescribed steps and procedures, suggesting the completed projects would be similar but not identical in appearance. It requires the capacity to *see* – to observe and record accurately and to simplify and condense visual form. Having an 'eye' is a prerequisite for acquiring the cultivated gaze of a professional designer. However, the primary intention of this first project of the curriculum is making the tacit process of perception, selection and visual abstraction more explicit. The project provides the students with some of the vocabulary and principles of design knowledge required to communicate their design intentions, both visually and verbally, to themselves and to others.

The Tile

The Tile (P5) is an Industrial design project and the first to move from two into three dimensions. It is also the first to provide students with a simulated real world problem to solve. It requires that students design and make a positive for producing monochromatic, low relief ceramic tiles intended for use as a decorative border pattern. A positive is required for making a 'negative' or hollow mould for producing multiple identical forms. The Tile project consists of two interrelated parts. The first uses prior knowledge of repeat pattern 'as a point of departure for designing a low relief border pattern'. The second requires understanding the principle and purpose of a positive. Figure 7.4 illustrates three identical low relief units constructed out of card to simulate what these tiles may look like when placed alongside one another to create a directional border pattern.

The project brief requires the design of a directional, mono-chromatic border pattern which is loosely based on a previously completed, multi-coloured repeat pattern. The brief stipulates the format and dimensions of the identical units which constitute the low relief pattern. The project's intention is that form be defined by 'the skillful use of different levels and

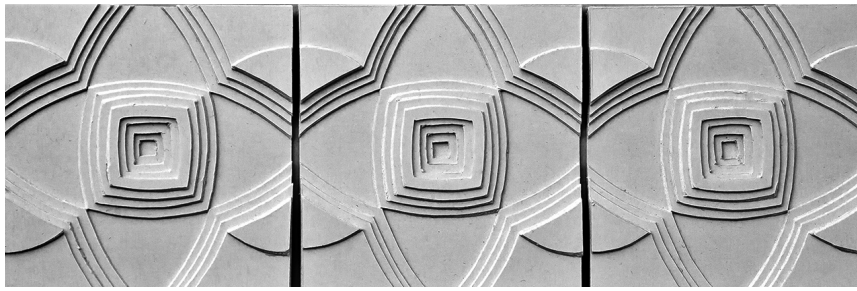

Figure 7.4 Example of the Tile project.

the transition between these levels'. In doing so, the projects provide students with another opportunity to use their prior knowledge of design principles of 'contrast, harmony, balance and rhythm' and so to deepen their understanding of these design concepts.

The simulated nature of the problem also requires consideration of the constraints and affordances provided by additional design elements such as form, light and shallow space. Both the acquisition of new and the reiteration of prior knowledge of design elements and principles extend the descriptive power and conceptual reach of formal visual language by layering and compounding their meaning. The intention of this reiteration is to further strengthen the semantic density of these design principles and terminology. Furthermore, the more ill-defined nature of the Tile project provides increased opportunities for generating potential design solutions. Designing the low relief border pattern requires aesthetic judgement and imagination, but cultivating a specialized gaze is not the only basis of achievement of this project. What matters equally is the acquisition of more discipline-specific technical knowledge of the explicit principles governing the production and use of positives.

The second part of the Tile project introduces more context-dependent knowledge related to positives and the use of moulds for producing three-dimensional objects in multiples. Moulds can be used for manufacturing anything from plastic toothbrushes to the giant brass propellers that power ocean liners. Understanding the principles that govern the design and making of positives requires knowledge of part–whole relations as well as knowledge of more specialized materials and procedures. For example, the brief suggests working 'from larger to progressively smaller layers' to prevent undercuts and reminds students that 'the design is for a ceramic tile and that design elements that could structurally weaken the tile should be avoided'.

The simulated design problem and the knowledge of specialized materials and procedures required by the brief result in a design situation which is more complex and discipline specific than one primarily concerned with

solving general, context-independent problems. The project requires aesthetic judgement and imagination to complete, signalling further cultivation of a gaze. Its primary intention, however, is to enable acquisition of the general principles governing the production and use of positives. So while semantic gravity is strengthened it remains weak enough to enable transfer to other similar design contexts, as will be illustrated below by the Jewellery project. Again, as with the Less is More project, this appears to be appropriate to a novice-level project.

Jewellery Design

The Jewellery Design project (P15), like the Tile, is an example of a simulated real-world project, but one that differs in its degree of 'authenticity'. Unlike the card representations of ceramic tiles, this project requires the manufacture of actual artifacts, strengthening semantic gravity considerably. The project requires the design and manufacture of earrings, a pendant and a ring, examples of which are illustrated in Figure 7.5.

The first part of the project calls for the design, illustration and fabrication of a 'pair of [chandelier] earrings and a pendant' with a 'chain', for a 'client' who 'loves pattern and stained glass windows' and whose 'only requirement is that it has some movement and some beads (colour) in it'. The requirement to use examples of precedent from the canon (stained glass and pattern) and the discipline (chandelier earrings and pendant necklaces)

Figure 7.5 Examples of the Jewellery project.

as points of departure for original work strengthens semantic gravity and situates this project firmly within the disciplinary context of Jewellery design. The second part of the project calls for creating a design for a signet ring that contains 'a letter from the Latin alphabet'. Fabricating the ring requires carving a three-dimensional positive of the ring out of wax for casting the ring in solver, 'which will then be cast in silver'.

Both parts of the Jewellery project introduce students to a range of specialized materials and techniques of fabrication for the first time. These techniques include piercing and cutting sheet metal, bending wire to make components of chains, earring sections and jump rings, incorporating colour by means of beads and carving a positive out of wax for casting a ring in silver. Creating wearable, comfortable jewellery furthermore entails considering size, weight and proportion in relation to the human body. This context-dependent knowledge strengthens semantic gravity considerably. At the same time the creative design of the earrings, pendant and ring rely on and reiterate conceptual and procedural knowledge introduced in previous projects: principles of formal visual language relating to part–whole relations and the concepts of a positive, low relief and simplification and stylization. This reiteration of prior design knowledge of fundamental design principles strengthens the semantic density characterizing this knowledge by extending their descriptive reach and compounding their meaning.

The Jewellery project requires the use of specialized materials as well as context-specific historical and disciplinary precedent to complete successfully. In other words, finding aesthetically pleasing and technically sound solutions to the brief requires a degree of insight into the situated nature of the design problem. As the fifteenth project of the curriculum, it also relies on prior knowledge of design principles and concepts to complete. As such it appears to be well-suited for the advanced beginner level. Finally, the project is ill-defined enough to allow for many potential design solutions. It provides ample opportunities to evoke gaze by requiring the imaginative integration of all these design knowledges into original pieces of jewellery, in accordance with the stylistic and aesthetic criteria provided by the 'client'.

The Bag

The Bag project (P6) is a Fashion design project and the first in the curriculum requiring the fabrication of an artifact from start to finish. As can be seen in the example provided in Figure 7.6, the project entails constructing a satchel-like bag from fabric and designing and making a personalized cover for it. This process requires knowledge of specialized procedures and techniques particular to fashion design, such as understanding how to use a pattern, an industrial sewing machine and decorative hand stitching techniques to construct and embellish a bag. The specialized nature of these knowledges strengthens their semantic gravity considerably.

The cover of the bag has to be rendered using a choice of 'different forms of applied decoration' and fabric embellishment techniques such as 'appliqué, beadwork, embroidery, quilting' or 'found objects, stencils and photo transfers'. The cover's design provides an opportunity to apply prior design knowledge, calling for students to 'apply the element and principles you have already worked with in previous projects'. However *how* students apply this knowledge is not specified and left for them to decide; for example, the use of colour and the number and type of embellishment techniques are a matter of personal choice. The ill-defined context and content of the cover's design, that requires only that it be 'inspired by [their] own interests', calls for a level of strategic problem-solving capacity associated with that of the advanced beginner bordering on the competent. The open-ended nature of the design problem assumes prior knowledge of the design principles, the discipline-specific techniques and the problem types of fashion design briefs. As such the project calls for a relatively developed cultivated gaze to complete successfully.

However, the positioning of this project so early (sixth) in the curriculum sequence is problematic given that there has been little opportunity for students to acquire the requisite problem-solving capacity, disciplinary knowledge and gaze. The design of the bag's cover effectively requires students to

Figure 7.6 Example of the Bag project.

rely on their untrained visual aptitude and/or their prior knowledge and experience of design to successfully complete the first complex composition project of the curriculum. Students with such prior knowledge and a more cultivated gaze, gained through prolonged experience in design in other contexts, would probably enjoy the wide choice of potential solutions offered by this project. They might respond to it with creativity and imagination. However, those students lacking the requisite experience and prior knowledge may have difficulty grasping the largely tacit criteria of the project.

This analysis suggests that the Bag project is not level-appropriate: it is positioned too early in the curriculum sequence. The project demonstrates what Maton (2009) refers to as a clash between curriculum aims and means, where achievement depends largely on a student's pre-existing gaze and design knowledge rather than on taught design principles. This mismatch may inadvertently privilege some students over others. It may even set some students up for failure. This is why sequence matters in design curricula.

Conclusion

Analysis of the project briefs confirms that the content of novice-level projects is general and independent of discipline-specific contexts. The purpose of these projects is to introduce core design knowledge and procedures and to begin the process of cultivating a design gaze. Figure 7.2 shows that although the projects are strengthening in semantic gravity and in semantic density from the novice to the advanced beginner levels, the organizing principles of the curricula still exhibit relatively weak semantic gravity and semantic density. This potentially enables core (but as yet not complex) design knowledge to be transferred between projects.

The analysis also confirms that projects suited to advanced beginner level provide content of varying levels of specialization and discipline-specificity. The specialized contexts of these briefs have the capacity to generate simulated design problems with more complex and context-dependent affordances and constraints. This in turn calls forth more specialized disciplinary knowledge and a cultivated gaze to solve these situated design problems. These more complex design problems provide opportunities for abstract design concepts and principles to be unpacked.

As illustrated in Figure 7.1 the levels of design expertise progress from a *rarefied code* of weaker semantic gravity and semantic density into a *worldly code* of stronger semantic gravity and semantic density as they reached 'competent'. Undergraduate students in this Diploma are unlikely to progress beyond competence since considerable time and experience is required to acquire the expert's capacity for intuitive problem solving. However, we predict that the conditions suitable for advanced beginner level will equally apply for all subsequent levels of design knowledge progression. In other words, the strengths of semantic density and semantic gravity will progressively both increase, culminating in self-directed, practice-based research. Thus

the conceptual framework enables not only description and explanation but prediction of the code conditions for different kinds of curricula.

We began this chapter with a concern for how curricula can give students epistemological access to powerful knowledge. This study reveals not only the kinds of knowledge and cultivated gaze that are valued by the DFC curriculum but the conditions for progression. The findings demonstrate the significance of sequence and illuminate how potential mismatches between curriculum aims and means can be prevented through careful sequencing of level-appropriate briefs. The findings also have significant implications for assessment as they bring to light the often implicit values which inform the recontextualizing gaze of curriculum planners. This can in turn translate into clearer, more explicit criteria for what kinds of knowledge matter most in particular design contexts. The ultimate goal is for students to grasp the realization and recognition rules (Bernstein 2000) of design discourse, thus empowering them to become part of a new generation of visually literate, productive design innovators.

What can we generalize from this design case about what makes the knowledge of vocational curricula special? From this case we shall draw out four principles that represent conjectures to be explored in further empirical research. First, not only do vocational curricula require conceptual knowledge (Wheelahan 2010; Young 2008), but progression also entails increasing complexity of this knowledge. What this increasing complexity entails will vary by field and its underpinning knowledge structures. Given that vocational and professional curricula are recontextualized regions the conceptual knowledge base, as noted earlier, may span a range of different kinds of knowledge – from the hierarchical structures of natural sciences to the horizontal structures of social sciences. Thus complexity may entail increasing levels of integration across different kinds of knowledge. The analysis gave some insight into what increasing semantic density looks like in a design curriculum. The question for further exploration is what does increasing semantic density look like in the vocational curricula of other fields.

Second, the design case study highlights that curriculum progression involves engagement with problems of increasing contextual specificity. These are characterized as problems that move from general to simulated to authentic. General tasks are de-contextualized and well-defined: that is, stripped of the complexities of real-world problems. Increasingly authentic tasks are ill-defined, problems that are open-ended and capable of generating a number of potentially successful solutions. A question for further exploration is the extent to which this movement from context-independence to context-dependence – increasing semantic gravity – characterizes progression in other vocational and professional curricula.

Third, the design case illustrates a contextually coherent curriculum: that is, the tasks select and integrate across different forms of conceptual knowledge according to the demands of context-specific problems of different design disciplines. It is the demands of practice that inform the selection, sequence,

pacing and evaluative rules. Furthermore it is the engagement with the particularity of the problem that enables, indeed *advances*, the capacity for conceptual development. In theoretical terms this means that strengthening semantic gravity helps in turn to enable the strengthening of semantic density, rather than the other way around. An interesting question would be to explore the organizing principles underlying vocational and professional curricula which lie on different points of the contextual/conceptual continuum.

The fourth principle is only alluded to in this chapter but developed more fully in the study (Steyn 2012). The design case illustrates how different knowledge practices specialize consciousness or cultivate a particular cultivated gaze: the gaze for fashion is not the same as that of industrial design. The sequence of the curriculum and, perhaps more importantly, the forms of pedagogy need to ensure the development of this gaze, this professional identity. Further empirical work is needed to explore the relationship between knowledge progression and the cultivation of the gaze.

This chapter is a contribution to a growing body of scholarship that draws on the work of Bernstein and LCT to reveal what makes different forms of knowledge in curriculum special. There have been calls for research into the relationship between knowledge structures and 'curriculum structures' (e.g. Maton 2009; Maton and Muller 2007). Central to this debate is the metaphor of 'verticality', a term coined by Muller (2007) to describe how new knowledge is produced and how it grows. As noted above there are fields where knowledge grows hierarchically through higher-order generalities and those where knowledge grows horizontally through development of new 'languages' or theory. Either way, the argument goes, these 'vertical discourses' have their basis of legitimation in their rise above particularity to increasing levels of generality. As Moore (2009: 148) describes, it is abstraction that 'drives up the power of knowledge'. There is a notion in Moore's argument of competence that has as its condition rising 'beyond the present and the particular', and 'context transcending dialogue moving in the dimension of the vertical' (2009: 247). While this may be helpful for conceptualizing verticality in some intellectual fields, the design case provides evidence that this may not be appropriate for the characterization of verticality in all fields. What the design case illuminates is a different kind of 'verticality'. This is not a verticality that is 'powered up' towards greater abstraction only but rather knowledge growth that requires a deep engagement with its context, with particularity, with specific problems and in the process transforms consciousness and identity. This is the powerful knowledge that our students will need to gain epistemological access into their chosen fields of study.

Note

1 This chapter is about the course at the time of study in 2010–2011. There have subsequently been a number of changes to the course including its name, scope and purpose.